



THREE HAWTHORN PARKWAY, SUITE 400  
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11 September 1992

Wayde Hartwick  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 West Jackson Boulevard  
Chicago, Illinois 60604

EPA Region 5 Records C



205274

EPA Contract No.: 68-W8-0089  
Work Assignment No.: 009-5PJ9  
Document Control No. 4500-09-AFXW

Re: Comparison of Site-Wide Reasonable Maximum Concentrations with Site-Wide  
Most Restrictive Cleanup Levels for Various Remedial Technologies

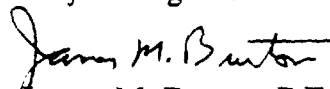
Dear Mr. Hartwick:

At your request Roy F. Weston, Inc. (WESTON®) has prepared a review of the candidate technologies for the ACS Site that evaluates the technologies under the most difficult circumstances they could encounter. For each chemical of concern, we isolated the site-wide reasonable maximum concentration and the site-wide most restrictive cleanup levels. Treatment of the most contaminated soil to achieve the cleanest remediation provides the greatest challenge to each technology. For each technology we have provided an approximate likelihood of meeting the challenge posed by each chemical. Extensive footnotes explain the theory and documentation behind each assessment. If you have any questions or require additional clarification, please call.

Very truly yours,

ROY F. WESTON, INC.

Robert H. Gilbertsen, P.E.  
Project Engineer

  
James M. Burton, P.E.  
Site Manager

RHG:JMB/kvh  
Attachment

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**LOW-TEMPERATURE THERMAL TREATMENT  
WESTON LT<sup>®</sup> SYSTEM <sup>1</sup>**

CHEMICAL	REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)	MOST STRINGENT CLEANUP STANDARD (mg/kg)	GENERAL EFFECTIVE- NESS	NOTES AND REFERENCES
VOCs			Very High	<sup>2</sup>
Vinyl Chloride	2.9	1.7E-06		
Chloroethane	16,000	2,700		
Methylene Chloride	380	0.00092		
Acetone	17,100	0.018		
Tetrachloroethene	46,000	0.0094		
1,1-Dichloroethene	360	0.0090		
1,2-(cis)Dichloroethene	320	0.062		
Chloroform	2,800	0.067		
1,2-Dichloroethane	440	0.0019		
2-Butanone	96,000	0.034		
1,1,1-Trichloroethane	150,000	0.60		
Carbon Tetrachloride	3,600	0.044		
1,2-Dichloropropane	66	0.0051		
Trichloroethene	19,000	0.01		
1,1,2-Trichloroethane	400	0.0056		
Benzene	1,500	0.0038		<sup>3</sup>
4-Methyl-2-Pentanone	61,000	0.079		
Tetrachloroethene	46,000	0.0094		
1,1,2,2-Tetrachloroethane	3.9	0.28		
Toluene	130,000	3.0		<sup>4</sup>
Chlorobenzene	1,000	1.4		
Ethylbenzene	23,000	2.0		<sup>5</sup>
Styrene	310	1.5		
Xylenes (mixed)	100,000	320		<sup>6</sup>
SEMIVOLATILES			Moderate	
Bis(2-chloroethyl)ether	200	1.7E-06		
1,4-Dichlorobenzene	5.5	0.010		
Isophorone	3,600	0.0012		
1,2,4-Trichlorobenzene	34.4	2.0		
Naphthalene	2,400	9.2		<sup>7</sup>
Hexachlorobutadiene	150	0.36		
2,6-Dinitrotoluene	0.749	0.044		
2,4-Dinitrotoluene	0.84	0.044		
n-Nitrosodiphenylamine	53	12		
Hexachlorobenzene	1.92	0.018		
Pentachlorophenol	180	0.018		
Di-n-butylphthalate	3,400	97		
Bis(2-ethylhexyl)phthalate	14,000	1.1		
Total CPAH	66.8	0.0026		

**LOW-TEMPERATURE THERMAL TREATMENT  
WESTON LT<sup>®</sup> SYSTEM (Cont'd)**

<b>CHEMICAL</b>	<b>REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)</b>	<b>MOST STRINGENT CLEANUP STANDARD (mg/kg)</b>	<b>GENERAL EFFECTIVE- NESS</b>	<b>NOTES AND REFERENCES</b>
<b>PESTICIDES/PCBs</b>			<b>Very Low</b>	<b>8 9</b>
Alpha-BHC	0.183	0.0047		
Beta-BHC	0.521	0.016		
Gamma-BHC (Lindane)	1.1	0.013		
Aldrin	0.898	0.0017		
Heptachlor epoxide	0.00635	0.0033		
Endosulfan I	1.2	0.63		
4,4'-DDE	0.45	0.16		
4,4'-DDD	1.35	0.12		
4,4'-DDT	28	0.088		
total PCBs	451	0.0063		
<b>METALS</b>			<b>Other</b>	<b>10</b>
Antimony	152	15		
Barium	5,730	2,600		
Cadmium	1,700	51		
Chromium (VI)	3,080	1,400		

**LOW-TEMPERATURE THERMAL TREATMENT  
CHEMWASTE X-TRAX SYSTEM**

CHEMICAL	REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)	MOST STRINGENT CLEANUP STANDARD (mg/kg)	GENERAL EFFECTIVE- NESS	NOTES AND REFERENCES
<b>VOCs</b>			<b>Very High</b>	<b>11</b>
Vinyl Chloride	2.9	1.7E-06		
Chloroethane	16,000	2,700		
Methylene Chloride	380	0.00092		
Acetone	17,100	0.018		
Tetrachloroethene	46,000	0.0094		12
1,1-Dichloroethene	380	0.0090		
1,2-(cis)Dichloroethene	320	0.082		
Chloroform	2,800	0.087		
1,2-Dichloroethane	440	0.0019		13
2-Butanone	99,000	0.034		14
1,1,1-Trichloroethane	150,000	0.60		
Carbon Tetrachloride	3,800	0.044		
1,2-Dichloropropane	68	0.0061		
Trichloroethene	19,000	0.01		15
1,1,2-Trichloroethane	400	0.0066		
Benzene	1,500	0.0038		16
4-Methyl-2-pentanone	61,000	0.079		
Tetrachloroethene	46,000	0.0094		
1,1,2,2-Tetrachloroethane	3.9	0.28		
Toluene	130,000	3.0		17
Chlorobenzene	1,000	1.4		18
Ethylbenzene	23,000	2.0		19
Styrene	310	1.5		20
Xylenes (mixed)	100,000	320		21
<b>SEMIVOLATILES</b>			<b>High</b>	
Bis(2-chloroethyl) ether	200	1.7E-06		
1,4-Dichlorobenzene	5.5	0.010		22
Isophorone	3,600	0.0012		
1,2,4-Trichlorobenzene	34.4	2.0		
Naphthalene	2,400	9.2		23
Hexachlorobutadiene	150	0.36		
2,6-Dinitrotoluene	0.749	0.044		
2,4-Dinitrotoluene	0.84	0.044		
n-Nitrosodiphenylamine	53	12		
Hexachlorobenzene	1.92	0.018		24
Pentachlorophenol	180	0.018		25
Di-n-butylphthalate	3,400	97		26
Bis(2-ethylhexyl)phthalate	14,000	1.1		
Total CPAH	66.8	0.0026		

**LOW-TEMPERATURE THERMAL TREATMENT  
CHEMWASTE X-TRAX SYSTEM (Cont'd)**

<b>CHEMICAL</b>	<b>REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)</b>	<b>MOST STRINGENT CLEANUP STANDARD (mg/kg)</b>	<b>GENERAL EFFECTIVE- NESS</b>	<b>NOTES AND REFERENCES</b>
<b>PESTICIDES/PCBs</b>			<b>High</b>	<b>27 28</b>
Alpha-BHC	0.183	0.0047		
Beta-BHC	0.521	0.016		
Gamma-BHC (Lindane)	1.1	0.013		
Aldrin	0.898	0.0017		
Heptachlor epoxide	0.00635	0.0033		
Endosulfan I	1.2	0.63		
4,4'-DDE	0.45	0.16		<b>29</b>
4,4'-DDD	1.35	0.12		<b>30</b>
4,4'-DDT	28	0.088		
total PCBs	451	0.0083		<b>31</b>
<b>METALS</b>			<b>Other</b>	<b>32</b>
Antimony	152	15		
Barium	5,730	2,600		
Cadmium	1,700	51		
Chromium (VI)	3,080	1,400		

**LOW-TEMPERATURE THERMAL TREATMENT  
CANONIE TACIUK SYSTEM**

CHEMICAL	REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)	MOST STRINGENT CLEANUP STANDARD (mg/kg)	GENERAL EFFECTIVE- NESS	NOTES AND REFERENCES
VOCs			Very High	39
Vinyl Chloride	2.9	1.7E-06		
Chloroethane	16,000	2,700		
Methylene Chloride	380	0.00092		
Acetone	17,100	0.018		
Tetrachloroethene	46,000	0.0094		
1,1-Dichloroethene	380	0.0090		
1,2-(cis)Dichloroethene	320	0.082		
Chloroform	2,800	0.087		
1,2-Dichloroethane	440	0.0019		
2-Butanone	99,000	0.034		
1,1,1-Trichloroethane	150,000	0.60		
Carbon Tetrachloride	3,600	0.044		
1,2-Dichloropropane	68	0.0051		
Trichloroethene	19,000	0.01		
1,1,2-Trichloroethane	400	0.0056		
Benzene	1,500	0.0038		
4-Methyl-2-Pentanone	61,000	0.079		
Tetrachloroethane	46,000	0.0094		
1,1,2,2-Tetrachloroethane	3.9	0.28		
Toluene	130,000	3.0		
Chlorobenzene 1,000	1.4			
Ethylbenzene	23,000	2.0		
Styrene	310	1.5		
Xylenes (mixed)	100,000	320		
SEMIVOLATILES			High	
Bis(2-chloroethyl)ether	200	1.7E-06		
1,4-Dichlorobenzene	5.5	0.010		
Isophorone	3,600	0.0012		
1,2,4-Trichlorobenzene	34.4	2.0		
Naphthalene	2,400	9.2		
Hexachlorobutadiene	150	0.36		
2,6-Dinitrotoluene	0.749	0.044		
2,4-Dinitrotoluene	0.84	0.044		
n-Nitrosodiphenylamine	53	12		
Hexachlorobenzene	1.92	0.018		
Pentachlorophenol	180	0.018		
Di-n-butylphthalate	3,400	97		
Bis(2-ethoxy)phthalate	14,000	1.1		
Total CPAH	66.8	0.0026		

**LOW-TEMPERATURE THERMAL TREATMENT  
CANONIE TACIUK SYSTEM (Cont'd)**

<b>CHEMICAL</b>	<b>REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)</b>	<b>MOST STRINGENT CLEANUP STANDARD (mg/kg)</b>	<b>GENERAL EFFECTIVE- NESS</b>	<b>NOTES AND REFERENCES</b>
<b>PESTICIDES/PCBs</b>			<b>Moderate</b>	<b>34 35</b>
Alpha-BHC	0.183	0.0047		
Beta-BHC	0.521	0.016		
Gamma-BHC (Lindane)	1.1	0.013		
Aldrin	0.898	0.0017		
Heptachlor epoxide	0.00635	0.0033		
Endosulfan I	1.2	0.63		
4,4'-DDE	0.45	0.16		
4,4'-DDD	1.35	0.12		
4,4'-DDT	28	0.088		
total PCBs	451	0.0083		
<b>METALS</b>			<b>Other</b>	<b>36</b>
Antimony	152	15		
Barium	5,730	2,600		
Cadmium	1,700	51		
Chromium (VI)	3,080	1,400		

# IN SITU VAPOR EXTRACTION SYSTEMS <sup>37</sup>

CHEMICAL	REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)	MOST STRINGENT CLEANUP STANDARD (mg/kg)	GENERAL EFFECTIVE- NESS	NOTES AND REFERENCES
VOCs			High	38
Vinyl Chloride	2.9	1.7E-06		
Chloroethane	16,000	2,700		
Methylene Chloride	380	0.00092		39
Acetone	17,100	0.018		40
Tetrachloroethene	46,000	0.0094		41
1,1-Dichloroethene	390	0.0090		
1,2-(cis)Dichloroethene	320	0.082		
Chloroform	2,800	0.087		42
1,2-Dichloroethane	440	0.0019		
2-Butanone	99,000	0.034		43
1,1,1-Trichloroethane	150,000	0.60		44
Carbon Tetrachloride	3,600	0.044		45
1,2-Dichloropropane	68	0.0051		
Trichloroethene	19,000	0.01		46
1,1,2-Trichloroethane	400	0.0056		
Benzene	1,500	0.0038		47
4-Methyl-2-Pentanone	61,000	0.079		
Tetrachloroethene	46,000	0.0094		
1,1,2,2-Tetrachloroethane	3.9	0.28		
Toluene	130,000	3.0		48
Chlorobenzene 1,000	1.4			
Ethylbenzene	23,000	2.0		49
Styrene	310	1.5		
Xylenes (mixed)	100,000	320		50
SEMIVOLATILES			Moderate	
Bis(2-chloroethyl)ether	200	1.7E-05		
1,4-Dichlorobenzene	5.5	0.010		51
Isophorone	3,600	0.0012		
1,2,4-Trichlorobenzene	34.4	2.0		
Naphthalene	2,400	9.2		
Hexachlorobutadiene	150	0.36		
2,6-Dinitrotoluene	0.749	0.044		
2,4-Dinitrotoluene	0.84	0.044		
n-Nitrosodiphenylamine	53	12		
Hexachlorobenzene	1.92	0.018		
Pentachlorophenol	180	0.018		
Di-n-butylphthalate	3,400	97		
Bis(2-ethylhexyl)phthalate	14,000	1.1		
Total CPAH	66.8	0.0026		



# IN SITU VAPOR EXTRACTION SYSTEMS (Cont'd)

CHEMICAL	REASONABLE CURRENT MAXIMUM CONCENTRATION (mg/kg)	MOST STRINGENT CLEANUP STANDARD (mg/kg)	GENERAL EFFECTIVE- NESS	NOTES AND REFERENCES
<b>PESTICIDES/PCBs</b>			Low	82 83
Alpha-BHC	0.183	0.0047		
Beta-BHC	0.521	0.016		
Gamma-BHC (Lindane)	1.1	0.013		
Aldrin	0.898	0.0017		
Heptachlor epoxide	0.00635	0.0033		
Endosulfan I	1.2	0.63		
4,4'-DDE	0.45	0.16		
4,4'-DDD	1.35	0.12		
4,4'-DDT	28	0.088		
total PCBs	451	0.0083		
<b>METALS</b>			Very Low	84
Antimony	152	15		
Barium	5,730	2,600		
Cadmium	1,700	51		
Chromium (VI)	3,080	1,400		

## NOTES AND REFERENCES

1. Thermal treatment systems generally: The predicted effectiveness can be viewed as a prediction of both a long-term and short-term effectiveness. All of the low temperature thermal treatment systems would involve excavation, which will expose any buried drums for removal and appropriate treatment. This would engender confidence in the permanence of the long-term accuracy of the tabulated predictions, as drum removal will eliminate potential future sources of renewed soil contamination.
2. LT<sup>®</sup> and VOCs: General technical literature suggests that low temperature systems are very effective against VOCs. (See, e.g., Holden, T., et al. *How to Select Hazardous Waste Treatment Technologies for Soils and Sludges*. Noyes Data Corporation. 1989.) The LT<sup>®</sup> system has demonstrated full-scale capability in treating VOCs. (Weston Project Summary, July, 1988.)
3. LT<sup>®</sup> has achieved the following removal of benzene at the field scale (ppb before: ppb after): (1,000: 5.2).
4. LT<sup>®</sup> has achieved the following reduction of toluene at the field scale (ppb before: ppb after): (24,000: 5.2).
5. LT<sup>®</sup> has achieved the following reduction of ethylbenzene at the field scale (ppb before: ppb after): (20,000: 4.8).
6. LT<sup>®</sup> has achieved the following reduction of xylenes at the field scale (ppb before: ppb after): (110,000: <1.0).
7. LT<sup>®</sup> has achieved the following reduction of naphthalene at the field scale (ppb before: ppb after): (4,900: <330).
8. LT<sup>®</sup> and PCBs: General technical literature suggests that low temperature systems are ineffective against PCBs. (See, e.g., Holden et al.)
9. LT<sup>®</sup> and pesticides: General technical literature suggests that low temperature systems are ineffective against pesticides. (See, e.g., Holden et al.)
10. LT<sup>®</sup> and metals: While thermal treatment will not remove metals, stabilization of the treatment residue has demonstrated effectiveness at preventing migration. (Holden et al.)
11. X-Trax and VOCs: General technical literature suggests that low temperature systems are very effective against VOCs. (See, e.g., Holden et al.) X-Trax has demonstrated effectiveness in reducing VOCs at lab and pilot scale. (Swanstrom, C. *Thermal Separation of Solids Contaminated with Organics*. Presented at HazMat '91 West. November 1991.)
12. X-Trax has achieved the following reductions of tetrachloroethene (ppm before: ppm after): (118: <0.25) at the pilot scale, and (109: <0.005) and (150, 0.094) at the lab scale.
13. X-Trax has achieved the following reductions of 1,2-dichloroethane at the lab scale (ppm before: ppm after): (38, 0.62).
14. X-Trax has achieved the following removal of 2-butanone at the pilot scale (ppm before: ppm after): (27.6: 1.5).
15. X-Trax has achieved the following reductions in trichloroethene (ppm before: ppm after): (28: <0.25) at the pilot scale, (103: <0.005) at the lab scale.

16. X-Trax has achieved the following removal of benzene (ppm before: ppm after): (7.2: 0.025) and (980: <0.21), both at the lab scale.
17. X-Trax has achieved the following reductions of toluene (ppm before: ppm after): (12: <0.10) and (45: <0.024) at the lab scale, and (136, 2.2) at the pilot scale.
18. X-Trax has achieved the following reductions of chlorobenzene (ppm chlorobenzene before: ppm chlorobenzene after): (61.8: 0.006) at the pilot scale, (110, 0.180) at the field scale.
19. X-Trax has achieved the following removal of ethylbenzene (ppm before: ppm after): (40, 0.050) at the pilot scale, (92: <0.024) at the lab scale.
20. X-Trax has achieved the following removal of styrene at the lab scale (ppm before: ppm after): (44: <0.050), (200: <0.005).
21. X-Trax has achieved the following reductions of xylenes (ppm before: ppm after): (68, <0.50) at the pilot scale, (77: <0.10) at the lab scale.
22. X-Trax has achieved the following reductions of dichlorobenzene (ppm before: ppm after): (537: 0.074) 1,2-dichlorobenzene at the pilot scale, (82: <0.33) 1,2-dichlorobenzene at the lab scale, (78.4, 0.001) 1,4-dichlorobenzene at the pilot scale.
23. X-Trax has achieved the following removal of naphthalene at the lab scale (ppm before: ppm after): (50: < 0.33), (450: 7.9).
24. X-Trax has achieved the following reductions in hexachlorobenzene (ppm before: ppm after): (79.2: 0.30) at the pilot scale, (7.9: 0.40) at the field scale.
25. X-Trax has achieved the following reductions in pentachlorophenol at the lab scale (ppm before: ppm after): (1,716: <0.66), (497: <1.6), (586: 7.6), (17.9: <0.63).
26. X-Trax has achieved the following removal of di-n-butyl phthalate (ppm before: ppm after): (77, 0.31) at the pilot scale.
27. X-Trax and PCBs: General technical literature suggests that low temperature systems are ineffective against PCBs. (See, e.g., Holden et al.) X-Trax, however, has demonstrated effectiveness in reducing PCBs at the lab and pilot scale. (Swanstrom, November 1991.) X-Trax generally achieves final PCB concentrations less than 25 ppm and frequently less than 10 ppm (Swanstrom, C. *Determining the Applicability of X-Trax for On-site Remediation of Soil Contaminated with Organic Compounds*. Presented at HazMat Central. April 1991.)
28. X-Trax and pesticides: General technical literature suggests that low temperature systems are ineffective against pesticides. (See, e.g., Holden et al.) X-Trax has demonstrated effectiveness at reducing pesticides at the lab scale. (Swanstrom, November 1991.) In one treatability study involving chlordane, heptachlor, and lindane, 97 percent reduction was achieved. (Swanstrom, April 1991.)
29. X-Trax has achieved the following reductions of 4,4'-DDE at the lab scale (ppm before: ppm after): (32: 0.57).
30. X-Trax has achieved the following reductions of 4,4'-DDD at the lab scale (ppm before: ppm after): (320: 1.3).

31. X-Trax has achieved the following reductions in PCBs in lab and pilot-scale tests (ppm PCB before: ppm PCB after): (12: <2), (50, <2), (97, <2), (120, 3.4), (630: 17), (1,600: 4.8), (2,800: 19), (7,800: 24).

32. X-Trax and metals: While thermal treatment will not remove metals, stabilization of the treatment residue has demonstrated effectiveness at preventing migration. (Holden et al.) X-Trax has achieved reductions in mercury, but mercury is an exceptional metal, as it is volatile at high temperatures. X-Trax has achieved no reduction in other metals.

33. Tackuk and VOCs: General technical literature suggests that low temperature systems are very effective against VOCs. (See, e.g., Holden et al.)

34. Tackuk and PCBs: General technical literature suggests that low temperature systems are ineffective against PCBs. (See, e.g., Holden et al.) However, Tackuk has demonstrated full-scale effectiveness against PCBs. (Swanson, S. *It's next year at last for tainted Waukegan Harbor*. Chicago Tribune September 8, 1991.)

35. Tackuk and pesticides: General technical literature suggests that low temperature systems are ineffective against pesticides. (See, e.g., Holden et al.) However, effectiveness against PCBs augurs well for effectiveness against pesticides, which have similar Henry's Law constants.

36. Tackuk and metals: While thermal treatment will not remove metals, stabilization of the treatment residue has demonstrated effectiveness at preventing migration. (Holden et al.)

37. In situ systems generally: The predicted effectiveness is best viewed as an indication of short-term effectiveness. In situ systems do not employ excavation, so they do not necessarily identify or remove buried drums. The potential presence of buried drums reduces the long-term reliability of the tabulated effectiveness, as ISVE would not affect the materials sequestered inside drums. Years after termination of ISVE, adequately remediated soils could conceivably become recontaminated in the long term as buried drums gradually corrode and release their contents.

38. ISVE and VOCs: Works well for volatile compounds with Henry's Law constants greater than  $3 \times 10^{-3}$  atm-m/mole. (Holden et al. See also, Hutzler et al. *State of Technology Review: Soil Vapor Extraction Systems*. NTIS PB89-194184. June, 1989.)

According to U.S. EPA, "vacuum extraction of VOCs has been applied at numerous sites by Terra Vac [an ISVE vendor] to reduce soil and groundwater contaminant levels from saturated conditions down to nondetectable. Therefore, concentration limitations [expressed in VOC treatment goals] are virtually eliminated [as a concern] with this technology." (U.S. EPA. *Terra Vac In Situ Vacuum Extraction System: Applications Analysis Report: Superfund Innovative Technology*. EPA/540/A5-89/003. July, 1989.)

39. Terra Vac has successfully extracted methylene chloride.

40. Terra Vac has successfully extracted acetone.

41. Terra Vac has successfully extracted tetrachloroethene. Terra Vac has used ISVE to remove PCE at the Tyson's and Verona Superfund Sites.

42. Terra Vac has successfully extracted chloroform.

43. Terra Vac has successfully extracted 2-butanone. (They call it methyl ethyl ketone). Terra Vac has used ISVE to remove ISVE at the Verona Superfund Site.

44. Terra Vac has successfully extracted trichloroethane.

45. Terra Vac has successfully extracted carbon tetrachloride. Terra Vac has used ISVE to remove carbon tetrachloride at the Barcelona Superfund Site.

46. Terra Vac has successfully extracted trichloroethene. Terra Vac has used ISVE to remove TCE at the Tyson's and Verona Superfund Sites. In a SITE program demonstration, the system achieved the following reductions (ppm TCE before: ppm TCE after): (22.98: 29.31), (3.38: 2.36), (6.89: 6.30), (96.10: 4.19), (1.10: 0.34), (14.75: 8.98), (227.31: 84.50), (0.87: 1.05).

47. Terra Vac has successfully extracted benzene. Terra Vac has used ISVE to remove benzene at the Tyson's and Verona Superfund Sites.

48. Terra Vac has successfully extracted toluene. Terra Vac has used ISVE to remove toluene at the Tyson's and Verona Superfund Sites.

49. Terra Vac has successfully extracted ethylbenzene. Terra Vac has used ISVE to remove ethylbenzene at the Verona Superfund Site.

50. Terra Vac has successfully extracted xylenes. Terra Vac has used ISVE to remove xylenes at the Tyson's and Verona Superfund Sites.

51. Terra Vac has successfully extracted dichlorobenzene.

52. ISVE and PCBs: Does not work well for less volatile compounds, such as PCBs, although addition of steam or or hot air may help. (Holden et al.) U.S. EPA has pointed out, however, "For those sites with numerous types of compounds (i.e., VOCs, PCBs, pesticides, and metals) a phased approach is often required. In these cases, it is prudent to remove VOCs first using vacuum extraction so that other technologies can then be applied more cost-effectively and safely. For example, in the chemical treatment or incineration of soil, which requires excavation, the health risk of excavation is minimized if the majority of VOCs are removed first, in situ, by vacuum extraction. Not only is the health risk minimized but also the excavation is accomplished faster and more economically because of the lower level of protection required." (U.S. EPA. July, 1989.)

53. ISVE and pesticides: Does not work well for less volatile compounds, such as pesticides, although addition of steam or hot air may help. (Holden et al.)

54. ISVE and metals: Does not work at all for metals, except for the relatively rare volatile metals, such as mercury, which is not present at ACS. (Holden et al.) But according to U.S. EPA, "Many methods used to chemically stabilize metals are more effective after vacuum extraction has removed VOCs." (U.S. EPA. July, 1989.)